Space-Based Detection of Earth-Threatening Asteroids: Sensor Design and Performance Analysis

Thomas J. Karr and Arno Ledebuhr
Lawrence Livermore National Laboratory
Livermore, California

We consider the prospects for space-based electro-optic detection of Earth-threatening asteroids. Large asteroids with diameter > 0.1 km, which have the potential to cause significant damage to Earth's biosphere, also are sufficiently bright in reflected Sunlight to be detected from space at great distances from Earth. We estimate the asteroid signal of reflected Sunlight, and the visible background clutter in space from other sources distributed over the celestial sphere. Very large asteroids with diameter ≥ 10 km would be clearly detectable from space at distances ≥ 10 AU, by small 0.5 m aperture visible sensors with modern megapixel CCD arrays. A constellation of such sensors that repeatedly scans over 4p steradians could detect, track and classify all large asteroids in nearby interplanetary space and provide early warning of a potential collision with Earth. A conceptual design is presented for the sensor satellite.